RESEARCH PROPOSAL

CLIMATE CHANGE PERCEPTION AND ASSOCIATED FACTORS AMONG HEALTH PROFESSIONALS IN NORTHERN STATE, SUDAN

A descriptive analytical cross-sectional study

Study location	Northern State, Sudan
Study duration	Three months
Target sample	100 health professionals
Study year	2026

Prepared for academic and ethical review

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Climate change is an increasingly important public health challenge. Changes in temperature, rainfall patterns and the frequency or intensity of extreme weather events can affect health directly through heat-related illness and injuries, and indirectly through changes in infectious diseases, food and water security, air quality and health-service delivery. The health effects are particularly concerning in settings with limited resources and high exposure to climate hazards (IPCC, 2022; Romanello et al., 2023).

Sudan is vulnerable to climate variability and change because of its arid and semi-arid environments, dependence on climate-sensitive livelihoods and existing pressures on health and social systems. Northern State experiences very high temperatures, aridity and desertification risks, as well as flooding and other climate-related stresses. These conditions may affect population health and the ability of health facilities to provide essential services (Elagib, 2010; UNEP, 2020; USAID, 2021).

Health professionals have an important role in recognizing climate-sensitive health risks, communicating preventive advice, supporting surveillance and emergency preparedness, and contributing to climate-resilient health services. Their knowledge and perceptions may influence their readiness to respond. Assessing their perceptions and the factors associated with them can help identify training needs and inform local planning (Kotcher et al., 2021; WHO, 2021).

1.2 Statement of the Problem

Despite the growing importance of climate change as a public health issue, there is limited locally generated evidence on how health professionals in Northern State perceive climate change, understand its health effects and respond to related risks in their professional practice. Gaps in awareness, risk perception, training or institutional support may reduce preparedness and limit the integration of climate-health considerations into routine services. This study will assess climate change perception and associated factors among health professionals in Northern State, Sudan.

1.3 Justification of the Study

The findings will provide baseline information on health professionals' climate change perceptions, identify groups that may benefit from additional training, and describe reported adaptive and advocacy practices. The results may assist health authorities and facility managers in strengthening climate-health education, preparedness and service planning. The study will also contribute evidence from a region of Sudan where research on this topic is limited.

1.4 Research Questions

1. What is the level of awareness and understanding of climate change and its health impacts among health professionals in Northern State?
2. How do health professionals perceive the relationship between climate change and human health, and their professional role in responding to related risks?
3. What climate-related experiences and advocacy orientations do health professionals report?
4. What climate-health adaptive practices are reported in their clinical and public health work?
5. Which socio-demographic and professional factors are associated with climate change perception scores?

1.5 Research Objectives

General objective: To assess climate change perception and associated factors among health professionals in Northern State, Sudan.

Specific objectives:

1. To assess health professionals' awareness and understanding of climate change, its causes and health impacts.
2. To assess their perceptions of climate-related health risks and the role of health professionals in responding to these risks.

3. To describe climate-related personal or community experiences and advocacy orientation.
4. To assess reported climate-health adaptive practices in clinical and public health work.
5. To examine associations between socio-demographic/professional characteristics and climate change perception scores.

1.6 Research Hypotheses

Null hypothesis (H_0): There is no statistically significant association between selected socio-demographic and professional characteristics and climate change perception scores among health professionals in Northern State.
Alternative hypothesis (H_1): There is a statistically significant association between at least one selected socio-demographic or professional characteristic and climate change perception scores.

1.7 Operational Definitions

Climate change perception: The participant's measured understanding, perceived health risks, views on professional responsibilities and related responses, assessed through the study questionnaire.
Health professionals: Eligible clinical and public health personnel working in selected health facilities in Northern State for at least six months.
Climate-health adaptive practices: Self-reported actions intended to prevent, identify or respond to health risks associated with climate variability and change.
Associated factors: Selected socio-demographic and professional characteristics, including age, sex, cadre, education, years of experience and previous climate/environmental health training.

CHAPTER TWO: BRIEF LITERATURE REVIEW

2.1 Climate Change and Health

Climate change affects health through multiple pathways. Rising temperatures increase the risk of heat stress and may worsen some cardiovascular, respiratory and renal conditions. Changes in rainfall, flooding and drought can influence water quality, sanitation, food availability and the distribution of some infectious diseases. Extreme events can also damage health infrastructure, interrupt access to care and increase demand for emergency services (IPCC, 2022; WHO, 2021; Romanello et al., 2023).

2.2 Health Professionals' Awareness and Perceptions

Health professionals are trusted sources of health information and are well positioned to explain climate-related health risks. International research has reported that many health professionals recognize climate change as a health concern, although levels of knowledge, perceived urgency and confidence in responding vary between settings and professional groups. Training and access to reliable information may influence their understanding and readiness to act (Wei et al., 2014; Kotcher et al., 2021).

2.3 Adaptive Practices and Associated Factors

Potential climate-health practices include providing advice on heat protection, considering environmental exposures during clinical assessment, participating in disease surveillance, communicating risks to communities and supporting facility preparedness. The extent to which these actions are implemented may depend on professional cadre, education, work experience, prior training, workload, available guidance and institutional resources (WHO, 2021; Kotcher et al., 2021).

2.4 Context and Research Gap

Northern State's hot and arid conditions, desertification pressures and exposure to climate-related events make climate-health preparedness important. However, locally specific information on health professionals' perceptions and associated factors remains limited. This study will address this gap by collecting structured data from health professionals working in selected facilities in the state.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Study Design

A descriptive analytical cross-sectional study will be conducted. Data will be collected once from eligible health professionals using a structured questionnaire.

3.2 Study Area

The study will be conducted in selected healthcare facilities in Northern State, Sudan. The proposed localities are Dongola, Merowe and Al-Dabbah. Facilities may include primary, secondary and tertiary levels, subject to administrative permission and operational access.

3.3 Study Population

The study population will comprise health professionals working in selected healthcare facilities in Northern State, including medical doctors, nurses and midwives, public health officers, pharmacists, and medical laboratory professionals.

3.4 Eligibility Criteria

Inclusion criteria: Health professionals currently working in a selected recognized health facility in Northern State for at least six months and willing to provide informed consent.
Exclusion criteria: Individuals who decline participation, are unavailable during the data-collection period, or are on extended leave.

3.5 Sample Size

The target sample size will be 100 health professionals. This is a pragmatic sample selected in view of the study's three-month timeframe, available resources and feasibility of reaching participants across selected facilities. It is not presented as a sample calculated to provide a 5% margin of error for the entire state workforce; therefore, findings will be interpreted with appropriate caution regarding precision and generalizability.

3.6 Sampling Technique

A stratified approach will be used to ensure representation of major professional groups and selected facilities. Where staff lists are available, participants will be selected randomly within strata. The number selected from each facility and professional group will be allocated proportionally to the eligible staff population. If complete staff lists are unavailable, a transparent facility-based recruitment procedure will be documented. The final allocation will be confirmed after obtaining staff numbers from participating facilities.

3.7 Data Collection Tool and Procedure

Data will be collected using a structured, self-administered questionnaire adapted from relevant climate-health perception domains, including the Climate Change Perceptions Scale for Health and Related Professionals and Students (CCPS-HARPS), where applicable. The questionnaire will contain sections on: (A) socio-demographic and professional characteristics; (B) awareness and understanding; (C) climate-health perceptions and professional roles; (D) experiences and advocacy; and (E) adaptive practices and training needs. The questionnaire is expected to take approximately 10–15 minutes to complete. Participation will be voluntary.

3.8 Validity and Reliability

The questionnaire will be reviewed by public health, environmental health and research-methodology experts to assess relevance, clarity and cultural suitability. If an Arabic version is used, it will be translated and independently back-translated to check conceptual consistency. Internal consistency of appropriate multi-item scales will be assessed using Cronbach's alpha; a value of 0.70 or above will generally be considered acceptable. Any modifications made after review will be documented.

3.9 Pilot Study

A pilot test will be conducted with approximately 10 health professionals from a comparable facility who will not be included in the main study. The pilot will assess clarity, wording, flow, feasibility and completion time. Necessary revisions will be made before the main data collection.

3.10 Study Variables

Outcome variable: Climate change perception score, including relevant questionnaire domains.
Explanatory variables: Age, sex, professional cadre, educational level, years of work experience, facility level, locality, previous climate/environmental health training and access to relevant information or institutional guidance.

3.11 Data Management and Analysis

Completed questionnaires will be checked for completeness, coded and entered into SPSS or another appropriate statistical package. Descriptive statistics will summarize participant characteristics and questionnaire responses. Scores will be calculated according to the instrument's scoring guidance. Associations between perception scores and explanatory variables will be examined using suitable tests, such as independent-samples t-test, ANOVA, Pearson or Spearman correlation, or their non-parametric alternatives, depending on the distribution and measurement level of the data. Multivariable analysis may be used if assumptions and sample size permit. Statistical significance will be set at $p < 0.05$, and effect estimates with confidence intervals will be reported where appropriate.

3.12 Ethical Considerations

Ethical approval will be obtained from the relevant institutional ethics committee and the competent health authority in Northern State before data collection. Administrative permission will be obtained from participating facilities. Each participant will receive an information sheet and provide written informed consent. Participation will be voluntary, and participants may decline or withdraw without penalty. No names or direct personal identifiers will be collected on the questionnaire. Data will be kept confidential, stored securely and used only for research purposes.

3.13 Limitations

The cross-sectional design will not establish causal relationships. Self-reported responses may be affected by recall or social-desirability bias. The pragmatic sample size and selection of accessible facilities may limit the representativeness and generalizability of the findings. These limitations will be acknowledged when interpreting the results.

3.14 Work Plan

Period	Planned activities
Month 1	Obtain ethical and administrative approvals; review and finalize the questionnaire; expert assessment; translation if required; conduct pilot study and revise the tool.
Month 2	Coordinate with selected facilities and collect data from the target sample of 100 health professionals.
Month 3	Code, enter and clean data; conduct statistical analysis; interpret findings; prepare and submit the final report.

3.15 Expected Outcomes

The study is expected to describe climate change perceptions among participating health professionals, identify professional and socio-demographic factors associated with perception scores, highlight reported adaptive practices and training needs, and provide recommendations for strengthening climate-health awareness and preparedness in Northern State.

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Note for final submission: The institutional name, ethics committee, participating facilities, final staff-based sample allocation and local budget should be completed or confirmed with the relevant university and health authorities. Bibliographic details should be checked against the original publications before submission.